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Definition

Information technology: The equipment, software and communications resources associated with the creation, storage, processing and communication of information in the form of data, text, image and voice. This definition includes the areas commonly referred to as data processing, personal computing, communications and office automation.

1. Executive Summary

1.1 The environment

Over the past decade there has been a dramatic increase in the use of information technology in the Ontario Government. In the 1986/87 fiscal year Ontario will spend an estimated $200 million on information technology related services. Despite reductions in the unit cost of computing, overall spending has increased at an average rate of 17% per annum (9% in real dollars) for the last few years. This growth rate is expected to continue.

Ministries have demonstrated that the use of technology can significantly improve the nature and delivery of government services and has the potential to contain or reduce the cost of government.

The rapid proliferation and diversity of technology presents major challenges to management. The rate at which existing technology evolves is accelerating. The number and diversity of innovations is increasing exponentially. All this equates to an inherently complex and rapidly changing environment for decision making. A further challenge is presented by the need to create policies which allow freedom and creativity for managers to effectively exploit technology while still coping humanely and responsibly with the implications of technical change on people, jobs and working conditions.

1.2 Strategy objectives

The government needs to position itself, in terms of knowledge, managerial competence and technical expertise so that it may effectively take advantage of the opportunities for cost savings and service enrichment. A need exists for an overall management process, a supportive environment and a rational policy framework within which all ministries can more productively avail themselves of technological opportunities as they arise.

Recognizing the need for a strategy for the management of information technology, the Information Technology Strategy Steering Committee (I.T.S.S.C.) was created in early 1984. The committee consists of senior line managers from ministries and the central agencies. The committee's objectives were to develop strategies that would ensure:

- Government derives maximum benefits from the use of information technology;
- Optimal organization structures and processes are developed so government can take full advantage of information technology;
- The quality of working life of individual employees is considered in decisions related to information technology;
- Prudence and probity are exercised in all use of public funds related to information technology.

As the recommendations developed, three key themes emerged as necessary and basic to a successful strategy. Those themes are:

- As a responsible employer, the government must concern itself with the human and organizational impacts of information technology;
- To encourage and support productive innovation, information technology policies should be clear but broadly-stated rules which avoid rigid procedures and specific technological prescriptions;
- Any general strategy must accommodate the differences among ministries.

1.3 The strategies

The conclusions of the study are detailed in the body of the report in the form of specific recommendations in five major areas:

a. the impact of information technology;

b. the information technology management process;

c. computers and telecommunications resources;

d. software and information resources;

e. information technology skills resources.

The major strategic directions supported by those recommendations are highlighted below:

- Managers at all levels must recognize the management of information technology as a critical component of their jobs. Just as financial and personnel management competence are considered mandatory today, so must the ability to apply and manage technology be viewed as part of a requisite skill set.
- Senior management must lead in the creation of information technology strategies based on the unique business needs of each ministry, and ensure that an overall structure is in place for the ministry's data systems.

- Major productivity gains will be achieved through the managed introduction and encouragement of end-user computing, i.e., the direct access to information technology resources by the managers and workers of the government.
- The government's information technology-related skills and knowledge need to be upgraded and maintained at a high level, for managers, systems staff and information workers in general.
- The impact of information technology on employees' needs should be explicitly considered in job design, training, working environment and measures to minimize loss of employment.
- The government would benefit from a central source of technology information to identify and promote strategic technology products having cross-ministry benefits.
- Ministries should review and adopt approaches to computer processing and local telecommunications that best meet their unique needs.
- Central government services should be strengthened in the area of computer facilities management and telecommunications networks.

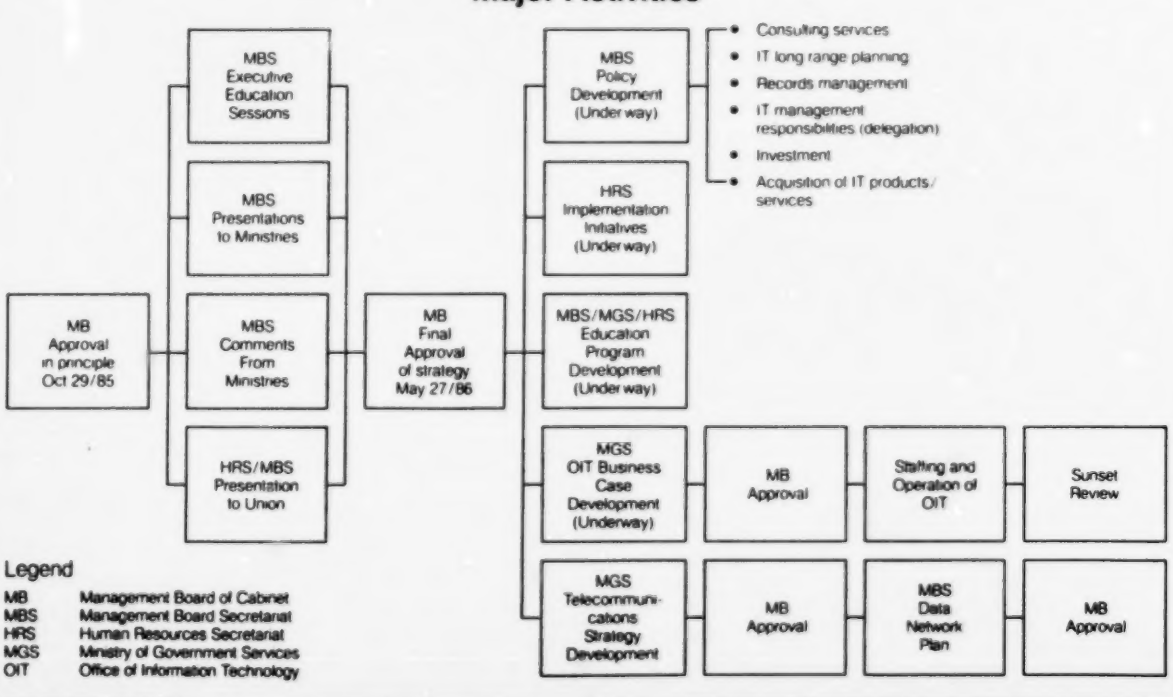
For the interested reader Chapter 8 contains a list of the 27 specific recommendations extracted from the body of the report.

1.4 Status

The strategies and recommendations contained in the report have been reviewed and approved by the Information Technology Advisory Council (I.T.A.C.) and the Technology Directions Committee of Deputy Ministers (T.D.C.). The proposed directions were also presented to representatives of the Ontario Public Service Employees' Union (O.P.S.E.U.).

On May 27th, 1986 the strategy recommendations were approved by the Management Board of Cabinet. The appropriate central agencies and ministries are now undertaking the development and implementation of the policies, guidelines and services necessary to support the strategies. See figure 1 for an overview of this process.

Figure 1 Strategy Implementation



2. Terms of Reference

Recognizing the existing importance and the even larger potential for the use of information technology, the Secretariat of the Management Board of Cabinet brought together a task force to address the issue of creating a corporate strategy for the management of information technology. The task force, the Information Technology Strategy Steering Committee, was formed in 1984 and operated under the direction of the Secretary of Management Board and the eight deputy ministers who form the Technology Directions Committee.

The resulting project involved more than 70 government executives, technical specialists and employees over a period of a year and a half. Seven ministry-led task forces were formed. Each task force examined and reported upon specific aspects of the management of information technology.

This report is a distillation of the reports produced by the project teams. It reflects the input received from over three hundred managers government-wide. The individual task force reports are listed in Appendix B.

2.1 Project objectives

There are two major objectives of the strategies study. Firstly, to develop government-wide (corporate) strategic directions for the management and use of information technology. Secondly, to support those strategies with the policy directives, guidelines and standards necessary for effective implementation.

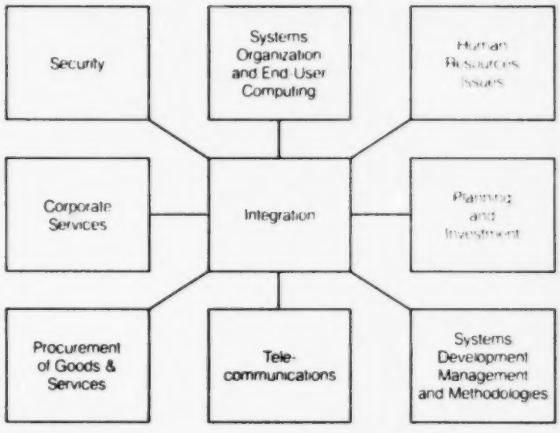
2.2 Scope

The strategies address the full range of information technology management. Figure 2 outlines the functional areas that were examined.

The recommendations are not limited to technology itself but include all the human resources, organizational and financial considerations in the use of information technology. Specifically:

- Management processes including short and long-term planning, acquisition of services, and technology management practices and methodologies;
- Human resources management considerations including employment, training, job design, working conditions, security and classification;
- The role of organizational units supporting the use of information technology at both the ministry and corporate level.

Figure 2 Strategy Areas



3. Impact of Information Technology

Over the next decade, information technology has the potential to change materially the government's services, how it is organized to deliver them and how it responds to increasing complexity and environmental change. The potential for radical change spans every ministry, program and activity.

3.1 Using technology strategically

Information technology is assuming strategic importance in this post-industrial age. Networks of bank Automatic Teller Machines open up new markets, lower costs and provide a competitive advantage. Airlines which sell the use of their reservation systems use them to give preference to their own flights. Distributors install computer terminals on the premises of their large clients to speed up ordering of supplies and to lock in the clients.

These private sector examples are motivated by the search for competitive advantage. In the public sector, the equivalent of competition is the sustained and intensive public accountability for economy and good service. The very need for modern and efficient management practices, using the best available methods, renders information technology of equal strategic importance to government. Its major strategic impact will be felt in five broad areas:

- Services to the public;
- New client groups served;
- Program delivery economics;
- Government organization and staffing;
- Government's image as a good manager.

Many government services already depend critically on information technology. Vehicle and driver licensing, OHIP claims and welfare payments are examples. By the 1990's, many more technology-based services will emerge. It is not unreasonable to expect the start-up of computer-based diagnostic services to remote doctors and hospitals, the use of automatic payments, and the provision of two-way government data services directly into people's homes. The possibilities are limitless.

As new services are developed, new "markets" emerge. The health care system for example will constitute a major market for improved hi-tech delivery mechanisms and administrative systems. A wide variety of funded agencies could benefit from access to a government computer communications network for electronic mail, access to data and the sharing of expensive software.

Program delivery economics are directly related to productivity. Government operations are highly information and labour-intensive with obvious implications for automation. But the potential goes well beyond the reduction of labour costs. The quantity and quality of services can be raised.

The Motor Vehicle Registration System at the Ministry of Transportation and Communications is a good example of a "strategic" application. The computer-based registration system maintains records of vehicle ownership. Not only has this system considerably simplified the vehicle registration process and improved the quality of public service but it has done so at no additional operating cost. Now for the first time, with vehicle registration tied to owners, registration can be refused for licenses with outstanding traffic fines — a powerful tool for reducing the approximately $25 million in outstanding traffic fines in Ontario. Furthermore, the timeliness of change in ownership records now assures police current and accurate data for inquiry and investigations.

Information technology has a role as an agent of organizational change. Chief executives can use decision-support and "expert" systems to widen their direct span of control and to extend specialized information and expertise to parts of the organization where these resources and skills are not currently available. The ability of telecommunications to compress or eliminate geographical and organizational distance opens up new possibilities for centralization or decentralization of functions and people. As more and more information moves from paper to electronic form, the nature of many jobs will change at every level in the organization. Jobs should be re-designed to reflect this technology component and duties re-allocated so that they are more complete, meaningful and satisfying.

Finally, private sector firms (and other governments) are increasingly using information technology to contain costs and to improve current services and deliver new ones. The government should be visibly using every available means to manage its affairs in the most cost-effective manner possible.

In summary, the most significant impacts of technology will not lie in streamlining the old ways

of doing things. Instead, they will be in doing the old things differently and in doing new things. Information technology must be viewed as a strategic vehicle for the improvement of services and organizations.

We recommend that:

1. **Ministry management recognize information technology as a powerful resource with which it can bring about significant program delivery and organizational improvement rather than as a set of limited-use administrative tools.**

2. **The effective use of information technology be recognized as an important aspect of the managerial environment.**

3.2 Need for a technology framework

Today the ability of most organizations, including government, to assimilate and use information technology lags far behind its potential. Senior managers intuitively feel that the technology is important, but, with few exceptions, they cannot assess its strategic value to their organization.

Achieving the real promise of technology and ensuring that its impacts are positive will require creative and active direction from the top. To be in a position to do this, senior management must have a framework within which to view their organization's information needs and relate them to both program objectives and technology solutions.

Today, many organizations using information technology experience frustrations attributable to the lack of an overall blueprint. Computer applications are conceived, designed and implemented in relative isolation. Systems professionals tend to focus on the systems development process, which begins at the point where they receive a request to investigate an information system idea. What is needed is senior level attention to the definition of a coherent "architecture" for each ministry's information systems.

Architecture refers to a planned structure or framework for an organization's information technology resources. The need for an architecture was not evident in the early days of computer systems. Then, individual systems, along with the data files they needed, were built to meet isolated needs. How all these systems and files fit together was not a concern because each was usually dedicated to a single function or a well-defined organizational unit.

Computer-based systems are now being used to bring together information from many different parts of the organization. Systems and data bases are being engineered to meet the needs of multiple different users. The word "integrated" is often used in conjunction with systems to denote large collections of computer programs which can perform multiple related functions.

In terms of services, an information technology architecture should encompass office automation and telecommunications as well as computer systems. In terms of the organization, it should encompass all major programs or activities on which information technology does or will have a significant impact.

The purpose of a systems architecture is twofold. Firstly, it provides senior management with an overview of the organization's information technology resources and how they have the potential to support the long-range goals and ongoing activities of the ministry. Secondly, it provides systems management with a master blueprint to guide their design and construction of individual data bases and systems. Within the framework provided by an architecture, systems professionals can proceed on individual projects, confident that the resultant system will contribute to and fit within the larger picture.

Increasingly, the existence of an architecture is being recognized as a prerequisite for the effective management of information technology in an organization. The management of information techology can be broken down into three levels as shown below:

— Systems Planning;

— Systems Development;

— Systems Implementation.

It is at the first and highest level that improvements are needed the most. This is the stage that identifies information technology opportunities and decides what projects should proceed into systems development. This stage is also where senior management involvement has the most value and impact. At this level, the issues are less technical than functional, organizational and financial. Their resolution requires the breadth of knowledge and the authority of senior management.

We recommend that:

3. **Ministry senior management take the lead in preparing long-range technology plans to support, reinforce and expand the ministry's business strategy. Such plans must be based on an overall information technology architecture that interrelates all major ministry applications and collections of data.**

3.3 Technology exploitation

Management depends on selective, high quality information for its decisions. Information technology is the one tool that can cope with vast quantities of data, summarize them, organize them and present the relevant parts to decision-makers.

In the future, technology will be applied not only to achieve savings in clerical costs, but to provide executives with better information to manage increased complexity. The so-called "decision support systems" will have a major effect on middle management and professionals. Information will be available when needed; tools will be available to assess quickly the probable results of alternative courses of action.

In the past, design and development of these systems would have been assigned to analysts and programmers in the information systems branch. Frequently, these systems practitioners are already overloaded with maintenance work and major development projects and are hard-pressed to respond to the burgeoning demand from users. Systems specialists will continue to be needed for the design, development and maintenance of large complex data bases and systems (e.g. Health claims processing). But to meet smaller-scale needs, more and more systems staff will have to shift their role to helping non-technical people find their own technology solutions.

Information technology is becoming too pervasive to remain the exclusive preserve of specialists. Organizations that wish to successfully implement the next wave of technology must place the tools directly in the hands of the employees who will use them. This strategy will affect not only managers and professionals but staff at all levels. The interest and willingness are already there. All that is needed is the right environment and the right set of tools, i.e.:

- access to "user-friendly" equipment at a reasonable cost (for example, small computers whose software avoids the need for extensive technical training associated with the use of large "mainframe" systems);
- availability of the data in groupings that are accessible and logically structured;
- availability of appropriate coaching and training for non-technical users.

We recommend that:

4. **The government commit to the development of an information technology environment which encourages and supports managers, professionals and staff to participate directly in the development and use of information systems ("End-User Computing").**

While the necessary hardware and software can be obtained, what is not available to most ministry managers is an integrated, reliable and logical set of data to access. Nor are sufficient training programs in place to educate and support users in finding and adapting their own technology solutions. Several recommendations elsewhere in this report are intended to improve the environment for end-user computing by specifically addressing these needs. But the onus is clearly on ministry management to establish the technology infrastructure, support resources and controls to foster the orderly growth of end-user computing.

3.4 Technology and people

The willingness of employees to participate and adapt will depend on the employer's concern with staff consultation and involvement, employment security and job design and training. Employees who are informed about environmental changes and technology plans and who are consulted on the best way to introduce technology will feel that they have the confidence of management and will be more likely to cooperate fully. External research has indicated that union consultation is also critical in the successful introduction of information technology. Organizations which actively involve their unions are more likely to avoid difficulty. The degree of actual participation must be mutually agreed upon.

We recommend that:

5. **Ministries involve their employees and the union at appropriate stages in the introduction of information technology.**

The Ontario Government has a process for reassignment of surplus staff which has been quite effective to date. Ministries go to considerable effort to absorb surplus staff through retraining, reassignment and natural attrition. However, as the overall pace of technological innovation accelerates, policies and practices will have to take into account the potential effect of the resulting changes on employment security.

We recommend that:

6. **The government ensure that a high degree of employment security related to the introduction and use of information technology is achieved by carefully planned retraining, redeployment, relocation and/or reassignment of staff, in addition to the employment security achievable as a result of natural attrition.**

The way in which work is organized and jobs are designed may well be the major opportunity for productivity improvement resulting from technological change. Proper job design considers the relationship both between the person and the job, and among groups of jobs. Effective job redesign techniques usually result in the employee learning a variety of skills in each job, making reassignment possible and non-threatening to the employee. Jobs designed in this way have been shown to have a highly motivating effect on staff.

The introduction of technology changes the nature of work, creates new skill and knowledge requirements and emphasizes the need for good management practices. The government must ensure that its reward system reflects these changes through non-economic as well as economic incentives. The effect of job redesign activities is that some jobs increase in scope and responsibility. The government needs to reconsider its classification rating system to ensure that it is flexible enough to recognize such changes. Increased autonomy, combined with greater diversity and scope of work can also provide their own reward.

When new technology is introduced, management, in consultation with staff, must consider and plan for the physical changes to the working environment necessary to accommodate the new technology. Such human factors are as important to the comfort and well-being of employees (and therefore their effectiveness) as to the efficient use of the technology. Their consideration requires attention to office layout, furniture and sound and lighting levels.

We recommend that:

7. **All information technology plans and the implementation of those plans consider staff needs in terms of job design, training and working environment.**

To date, technology has had the greatest impact on clerical and secretarial work, jobs predominantly held by women. Future developments will likely continue to affect these areas, as well as the administrative and management jobs to which women are now advancing.

Careful planning will be required to ensure that the objectives of the government's Affirmative Action program continue to be met and that women benefit from the career opportunities which will be created by the introduction of technology.

We recommend that:

8. **Procedures be developed for monitoring and evaluating the impact of technology on women, and ensuring that women are able to take advantage of opportunities presented by technology.**

Attention to human factors comes at a cost which has too frequently been ignored in the substantiation for new information systems. If the government is to realize the potential benefits of the involvement of its employees in technology implementations, it must also recognize the associated costs. A sound business case for introducing technology should include these costs.

The assessment of soft or intangible benefits has always been difficult and is particularly so in an atmosphere of financial restraint. They are, nevertheless, often the most significant benefits of information systems. Benefits such as cost avoidance, social benefits, improved service delivery and better decision-making are not readily measurable in the concrete terms currently required by government policy in proposals for information systems, but they must be taken into account when new technology investments are considered. One way in which they could be assessed in government is in relation to ministries' Management by Results (MBR) objectives.

For example, assume that a given number of occupational health and safety inspections is set as a desirable objective for the government, but is not achievable at current staffing levels. A proposed system to support inspectors in on-site visits may be partially justified in traditional business case terms. The remainder of the justification comes from the non-quantifiable benefit of achieving the desirable level of inspections — a level set with the aim of having fewer injured workers (a social benefit), fewer demands on health claim and compensation funds (a financial benefit) and improved service delivery.

We recommend that:

9. Ministry investment guidelines for information technology projects be expanded to include related end-user and employee costs, as well as benefits of a social nature, service improvements, improved decision-making and productivity gains.

4. Information Technology Management Process

If the Ontario government is to position itself so as to take advantage of developments in information technology and to protect its current investment, a suitable and supportive policy and managerial framework must be in place. That framework must not only provide flexibility and support for ministries in the beneficial use of technology but must also provide a means of ensuring accountability and good management.

4.1 Accountabilities

A basic organizational issue is the division of responsibility for technology management between central agencies and the ministries. Presently, even the largest and most advanced ministries must seek approval from Management Board for all significant systems proposals. The effect of this process has been to leave the ultimate decision-making authority for all major technology initiatives in the hands of Management Board. A number of ministries have now attained a level of management expertise in technology that should enable them to take on this responsibility themselves. Ministries differ widely in both their need for information technology and their capacity to plan and manage it effectively. The general climate in the Ontario Government encourages each ministry to provide most or all of its own resource management. This is true today for financial and human resources. The time has come to extend the same philosophy to the management of information technology resources, for those ministries which demonstrate their capability to plan and manage these resources.

At the same time, ministries must be held accountable for their results and for observing sound management practices. Thus there is a legitimate need for corporate-level policies and controls to ensure that ministries are held accountable.

We recommend that:

10. **Authority and responsibility for the use of information technology be delegated to Deputy Ministers, with a clear understanding of their accountability to the Cabinet for results and to Management Board for the observance of good technology management practices.**

11. **To maintain accountability, ministries submit to Management Board their short and long range plans for the use of information technology, with acceptance of the plans being the basis upon which authority is initially delegated, and with continued delegation being based on achievement of planned results.**

4.2 Long-range planning

The primary uses of the strategic information technology plan will be to:

- provide ministry senior management with an overview of the information technology role in support of ministry objectives, the information technology resources required, and its expected impact; and
- provide management of the systems function with a master blueprint to guide both short-term plans and budgets and the design of individual systems, data bases and networks.

The document will also serve to inform the Management Board of Cabinet about ministry long-range information technology plans and their relationship to both ministry program plans and related information technology initiatives in other parts of the government. Certain components of the plans will be useful to central agencies in consolidating the need for common services or resources, and in identifying opportunities for sharing of data, software or methodologies.

To meet the above needs, ministry strategic information technology plans should cover all computer-based systems, including office automation, as well as telecommunications requirements. Organizationally, the plans should address all programs and activities of the ministry on which information technology has or will have a significant impact. The long range plans should cover a time horizon of about 5 to 7 years.

The strategic information technology plan will be divided into two parts.

- The first will deal with the main directions of technology in the ministry, how these support the ministry's overall business strategy, and their expected impact on human resources, funding and levels of service. Included here will be an architecture for the ministry's information

resources and for the systems that collect and process those resources. The plan will also contain a technology strategy covering the kinds of technology (e.g. hardware, software, communications) required to support the ministry's data and systems architecture

- The second part will contain the methods, steps and resources required to implement the strategy.

The preparation of such a technology strategy is a complex and difficult undertaking. It will not be successful unless the use of technology is viewed in strategic terms and has the direct attention of a senior executive who can insist on a ministry-wide approach.

Such an approach helps ensure that specific projects are consistent with and supportive of the overall plan. It also permits some projects, which may be difficult to justify in isolation, to be seen as indispensable parts of the larger picture.

Many large, information-intensive companies in the private sector have appointed a Corporate Information Executive (CIE) at the executive level for precisely this reason. The CIE usually has broader responsibilities than the executive in charge of the information systems branch and, to be effective, must report to the chief executive officer.

We recommend that:

12. **Ministries designate a senior executive to be responsible for the development and integration of all information technology plans relating to computers, telecommunications and office systems.**

4.3 Management Board Secretariat role

The delegation of authority, the requirement for planning and rapid advances in technology all create a need for leadership from the centre. There is a need for both technology leadership and managerial leadership. The former is addressed in Chapter 5. Managerial leadership would consist of playing a supportive role in plan development and the establishment of sound technology management practices, as well as provision of advice to Management Board on the quality of ministry plans and, as appropriate, specific projects. It is Management Board's responsibility to review ministry plans and to ensure that good management practices exist in ministry operations. Because it is Management Board's authority which will be delegated, it is appropriate for the Board to lead in the development of a proper managerial environment.

We recommend that:

13. **The Information Technology Division (ITD) of the Management Board Secretariat, assume the role of technology management leadership for the government, through support of ministries in the establishment of sound technology management practices, and through advice to Management Board on the quality of and performance against ministry plans.**

In this role, the ITD should be principally concerned with the management process for information technology — i.e. planning and control functions — not with the details of the technology itself or operational systems matters. It can promote and encourage sound management practices within the ministries through the issuance of information technology management guides and through working cooperatively with senior ministry managers.

5. Computing and Communications Resources

Taken together, the strategies proposed below will lead to a gradual shift of the Ministry of Government Services (MGS) away from the sale of centralized processing power. The emphasis will increasingly be upon the management of large government data bases and communications networks and, perhaps, facilities management of distributed processing systems for ministries.

5.1 Computer processing strategies

As computer equipment costs continue to decline, computing resources can economically be dedicated and tailored to meet the needs of a single application, a single user or a local group of users. Such flexibility is particularly important given the widely varying size and nature of government ministries and programs. It also means that users obtain more direct control over the computing resource and its cost.

To meet the needs of systems development professionals and end-users, computing facilities must be easy to access, easy to use, and fast in response. Smaller computers, installed at the local branch or divisional level, can often offer software and interface languages that are considerably less complex than those used on large mainframe computers. Their lower overhead, relative simplicity and quick response time can contribute to substantial productivity gains in the system development function.

In short, it is now frequently easier, cheaper and faster to both build and operate systems on small-scale equipment than on large mainframe computers. This does not mean the imminent demise of large central-computer facilities. Some government systems (health insurance claims, vehicle licensing, etc.), by virtue of their volumes and complexity, will continue to require the use of large computers. Further, the large investment in existing systems and data bases using mainframe technology will ensure the continued use of this type of computer for many years to come. But, as the cost of computing declines, sharing this kind of computing facility may not necessarily be the best answer for all ministries.

Each ministry should choose the most suitable approach(es) to computer processing based on its own operational and technical requirements and economic considerations. Government-wide policy for computer processing should not favour a common approach which ignores differing needs among ministries. However, it is important that each ministry pay conscious attention to its processing approach as part of its overall technology architecture.

We recommend that:

14. **Corporate policies are changed to give ministries the freedom to choose, acquire and manage the computing facilities that best meet their needs within the framework of the comprehensive long-range information technology plan submitted to Management Board. Business cases for ministry datacentres would have to be justified on the basis of benefits not only to the ministry but to the government as a whole.**

15. **MGS continue to provide shared processing services to the ministries, on a cost recovery basis and in competition with the private sector. MGS is to be the only ministry offering such services.**

One of the alternatives to the existing arrangements is greater use of the private sector. Ministries are allowed to award data processing contracts to private sector firms when they offer a better combination of price and service. The proposed strategy would encourage more tendering and thus may lead to more contract awards to the private sector. But the real competition for any computer service bureau today is cost-effective in-house computers. The proposed strategy recognizes this fact, encourages the ministries to seriously evaluate in-house processing and allows the issue of privatization to be handled on a case-by-case basis.

There may be some concern that this new direction will result in a precipitous rush by ministries to create their own general-purpose data centres. This concern should be allayed by several aspects of the required process, specifically that:

a) All ministries will be required, as an integral part of their long-range technology plan, to review and assess their technology architecture, including their computer processing environment. As part of this planning process,

ministries must identify current or planned connectivity requirements with other ministries for data and communications.

b) Where a ministry's long-range plan calls for all or part of its processing resources to be in-house, such a proposal will have to be supported by a proper business case describing both ministry and corporate cost impact.

5.2 Telecommunications services

Networks are the key to many potential service enhancements and productivity improvements. As thousands of microcomputers are installed, as ministries move toward distributed processing and as more information is stored in electronic form, the demand for telecommunications will accelerate. Much of this demand will originate from users at the grass-roots level, with office automation as the driving force. By the 1990's the volume of data communications may well exceed that of voice communications.

Office automation, at least initially, is of most benefit at the local level, within work groups of people who are physically proximate and have related tasks and objectives. The nature of these activities varies widely from one work group to another. These variations, plus the need to adopt an evolutionary approach to office systems, argue strongly for allowing local freedom to customize and adapt available technology to meet unique local needs.

Local, limited-distance telecommunications within ministry premises (i.e. intra-ministry and intra-building) are accomplished by means of "Local Area Networks". Microcomputers are crucial components of these networks and their usefulness will in large part depend on their ability to communicate with each other and with remote computers for electronic mail, document distribution and access to data. While permitting a degree of local autonomy, ministries will have to ensure the development of technical standards so that their local area networks can communicate with each other and with external (non-ministry) networks. From the viewpoint of inter-connectivity, a ministry-wide standard for local area networks would be desirable.

Beyond the level of Local Area Networks (i.e. once the communication need is inter-ministry or inter-building) telecommunications technology becomes much more complex, the economics change, the common carriers enter the picture, and connectivity problems abound. Ministries, on their own, are no longer in a position to obtain optimal solutions, because they no longer control all the variables:

- Economies of scale require the pooling of requirements from multiple ministries and bulk buying from common carriers;
- Most ministries cannot afford highly-qualified communications specialists on staff;
- Establishing connections among a variety of different organizations and technologies requires the authority to set and enforce standards.

In short, network services of all kinds (voice, data and video) between geographically-separated locations are much better handled on a government wide basis. Not only will this approach be less expensive overall, but it has the potential to open up to ministries opportunities for advanced communication services which they could never contemplate providing on their own.

Many of these advanced services are based on the use of digital technology for communications, as opposed to the older analog technology. Digital communications are more inherently accurate, can be software controlled using stored-program computers, and can be used to combine voice, video and data signals into a single transmission channel. To get these advantages, the communications industry is gradually converting its older analog equipment to digital facilities.

Ultimately we foresee the emergence of an integrated, digital provincial network for all forms of telecommunications including voice, data and video. While the development of such a network will be evolutionary, the strategies proposed are designed to lead the government in this direction. A long term strategy is needed to provide a blueprint for the integration of communications government-wide.

We recommend that:

16. **Each ministry be responsible for setting standards for, and managing all telecommunications networks which are internal to the ministry and are intra-building ("Local Area Networks");**

17. **MGS be responsible for managing all inter-ministry and inter-building telecommunications, and for developing and recommending to**

Management Board any related standards;

18. MGS prepare a strategy for the delivery and management of telecommunications province-wide. The strategy should consider the existence today of individual ministry communications systems which have unique requirements related to security, radio transmission and remote location. As part of this strategy, MGS should prepare a phased plan for the design, development and expansion of an integrated provincial voice/data network, utilizing digital technology wherever practical.

A note on procurement of microcomputers and office systems

As ministries acquire the computing facilities appropriate to their needs, attention should be given to the cost-effectiveness of the procurement process. This is particularly true of microcomputer networks and office automation systems which include large numbers of relatively small computers. Within the ministry's overall strategy, a technology tender is an effective way to acquire these systems.

A technology tender defines the framework — intended use, communication needs, desirable software — in which the system must work. Vendors are asked to respond with their technology solutions on the understanding that actual acquisitions will be made over a specified period of time. The product lines chosen as a result of the tender are then ordered from the winning vendor(s) as needed, to the maximum of the original contract.

The technology tender approach is not only consistent with better planning on the part of ministries, but it is the preference of the vendor community when compared to repetitive, small volume purchases.

6. Software and Information Resources

As hardware costs continue to decline, the costs of software continue to escalate. In the mid 1970s, organizations on average spent 80% of their systems budget on hardware and 20% on software. Today, that ratio is approaching 50/50. By 1990, it is forecast that software will require 80% of the information systems budget and hardware will drop to 20%. This projection points to the need to be more concerned with the economies of scale of software development than with those of hardware.

To a large degree, this shift in the economics of computing stems from the trend toward "friendly" end-user computing. End-user software typically requires much of the external complexity to be built into the software to simplify commands and make allowance for human imprecision. As a consequence, the proposed strategy of encouraging end-user computing will depend heavily on the availability of large quantitites of complex, pre-built software for computers of all sizes.

6.1 Software systems

The days when most organizations could afford to custom build all their application systems are fast disappearing. With the spread of thousands of microcomputers into offices, users will have to rely heavily on packaged software. In the large mainframe computers, general-purpose software will also play a major role. Fortunately, the availability of low-cost computer power is encouraging the growth of general-purpose software products which can be tailored to specific requirements by users with relatively little technical knowledge.

This trend has significant potential for the government's software development strategy. First, there is an obvious opportunity for shared or common software across the government in a number of areas. This opportunity is discussed later in the broader context of "strategic information technology products". But software development is and will remain a ministry responsibility. It is important that every ministry be aware of the "make or buy" choice with respect to software, and avoid the temptation to custom build software that is already available in packaged form.

We recommend that:

19. As a matter of policy, the "buy" option always be considered by ministries as an alternative to custom software development.

6.2 Strategic information technology products

The impact of the management recommendations discussed in Chapter 4 will be to increase individual ministry attention to and autonomy over their own uses of information technology. While we believe that this is an appropriate response to the increasing pervasiveness and down-scaling of technology, this direction, by itself, does not allow the government to capitalize on opportunities for common technology products and approaches.

The pace at which new information technology products, methods and services are appearing makes it virtually impossible for any single ministry to keep up-to-date. There are hundreds of vendors and thousands of products. Better methods are needed to evaluate the many alternatives, because large amounts of money are involved, not only directly, but indirectly in terms of conversion, training and lost business opportunities. Both large and small ministries have expressed the need to access a source of expert-level knowledge about government-related information technology trends and products, as a critical input to their technology planning.

Many new products, methods and services present significant opportunities to a number of ministries, and as such can be leveraged across the government. For example:

- The use of general purpose software products can lead to significant savings when compared to custom development, even for a single user. These savings can, in some cases, be multiplied over several ministries.
- Automated design and development tools for the building of information systems can reduce both time and cost for the introduction of information technology by factors ranging from two to ten and more. Such new approaches have obvious applicability across the government.

- Guidelines and methodologies for various aspects of the technology planning and development process are indispensable aids to good management. Such "how to do it" handbooks would benefit all ministries as the basis for preparing their own methods and standards.
- Educational curricula in technology for general management, technical training for systems specialists, and training for the use of government-wide technology products will be largely common to all ministries.

We recommend that:

20. **The government recognize the need to identify, acquire and support strategic information technology products that have wide application and benefit to multiple ministries.**

6.3 Strategic technology focus

The most significant economies of scale in the future will be in the areas of software and information resources. Yet there is currently no government entity with a mandate to identify and help exploit these opportunities.

In order to take advantage of commonalities across ministries, there is a need for a centre of technology leadership, with the mandate to take a government-wide view.

A cooperative, coordinated approach to new technology research, evaluation and introduction would offer a number of benefits. These include better use of scarce funds and expert human resources, the ability to transfer knowledge among ministries, and the ability to broaden the scope of product evaluation.

We recommend that:

21. **The government consider the establishment of an Office of Information Technology (OIT) with the mandate to:**

    a) **identify, research and evaluate strategic information technology products;**

    b) **disseminate current information regarding technology trends and developments and strategic information technology products;**

    c) **identify effective methodologies and develop guides in such areas of technology as are considered to have general applicability; and**

    d) **develop curricula for information technology education and training, for managers, end-users and specialists.**

In addition to specialized knowledge existing inside the government, there is substantial expertise in the private sector which would be of great benefit to the government if this knowledge could be effectively transferred. Accordingly, the OIT should ensure that its staff includes acknowledged private sector experts in relevant areas of information technology, on appropriate short to medium term assignments.

Technology evaluation and education would not be the exclusive prerogative of the OIT. Its role would be to provide information technology expertise of value to all ministries, over and above the specialized knowledge which any one ministry may acquire. The OIT should in fact ensure that the specialized knowledge of any one ministry is made available to all other interested ministries.

Ministries will continue to do their own research and evaluation, and participate with the central group only as they wish. We are confident, however, that most ministries will take advantage of a government source of high-level expertise, to supplement their own skills and resources and reduce the risk of "re-inventing the wheel".

Implementation considerations

The success of a new corporate body cannot be taken for granted within a government organization characterized by ministry autonomy and accountability. The image of the OIT, the rules under which it operates, and the mechanisms by which its priorities are set, are critical to its success.

The OIT needs to be (and be perceived to be) impartial, and should therefore be organizationally separate from any control or service group. It must be responsive to the needs of many and fair in the allocation of its resources. Further, it cannot be used in support of the control mandate of any central agency.

To have a pragmatic orientation, the OIT should concentrate its efforts on products and methodologies of real benefit to ministries. Preferably it should not provide fee-for-service consulting as that would narrow its focus to the problems of a limited number of ministries. Fee-for-service consulting belongs more properly with the private sector. The OIT should probably

therefore be funded, as opposed to operating in a charge-back mode.

A mandate such as that proposed for the OIT is new to the government. Its overall value and success should therefore be reviewed after a reasonable period, to ensure that the anticipated benefits are being obtained.

We recommend that:

22. The Office of Information Technology be established under the following rules:

a) that it submit a business plan to Management Board for approval within three months of these recommendations being approved by the Board;

b) that it be accountable to an Executive Board, representing both technical and program disciplines;

c) that priorities for resource allocation of the OIT be set by its Executive Board, in response to requests received from ministries, central agencies, Systems Council and its own staff; and

d) that the majority of its work be carried out in conjunction with a ministry or ministries, based on real identified technology needs with applicability across the whole government.

6.4 Innovation funding

The long range planning process should provide for regular information technology investments — i.e. those investments that meet the criteria established for business cases and are intended to increase productivity in the broad sense of that term. Other project opportunities will arise that seem to have potential, but for which business cases cannot be demonstrated. These will require experimentation or pilot projects to demonstrate their value. For this purpose, there should continue to be a corporate fund to finance innovative projects that have potential benefit to multiple ministries. Awards of such funds should be made by a high-level inter-ministerial committee, such as the Technology Directions Committee, supported by the advice of technical experts.

We recommend that:

23. Innovative, high-risk projects using state-of-the-art technology and with potentially attractive government-wide benefit be financed through a Technology Opportunity Fund and carried out by the sponsoring ministry, with OIT participation at the option of the ministry.

7. Information Technology Skills Resources

7.1 Training

To achieve the productivity results expected from information technology, the government must ensure that all of its employees have the education and training necessary to properly fulfill their functions.

In the past, this statement would have been focussed solely on the systems specialists. Now, information technology will touch virtually every job in the public service. There is therefore a need for a long range human resources planning activity which anticipates the involvement of all employees in some aspect of the technology and plans for the necessary education and training.

Most employees and managers will ultimately be using a terminal or microcomputer. Managers of functions such as human resources, administration and audit will have to have sufficient knowledge and understanding of the technology to participate in the planning and review of its use. Senior managers will have to be knowledgeable enough to be involved in the overall information systems architecture development and in the setting of the ministry's technical directions. Systems branches must strengthen their purely technical skills to understand and exploit new technologies, and strengthen their consultative skills to advise and assist users who are increasingly involved in their own system development and operation.

Development of the necessary knowledge and skills in most government employees will require careful attention to education programs and on-the-job training activities.

We recommend that:

24. **Ministries and the Human Resources Secretariat institute a long range human resources planning activity with respect to information technology in order to identify and plan for the education and training necessary for the government's employees and managers.**

25. **The Human Resources Secretariat ensure the availability of education programs addressing the following needs:**

    a) **Skills in information technology and its management, for the government's senior managers;**

    b) **Skills in information technology, for employees who will use it in their jobs and for their managers;**

    c) **Skills in business and general management, for managers in the information technology function;**

    d) **Skills in consultative assistance for employees now in technical functions;**

    e) **Advanced technical skills for employees who are to be the government's technical specialists.**

7.2 Human resources management planning

With respect to information technology specialists, the government has a serious recruitment and retention problem. For several categories of specialist, telecommunications being a prime example, government salaries fall short of the private sector. The problem is exacerbated by the shortage of people in some specialities, regardless of income offered. Overall, the government now risks not only being unable to acquire the necessary specialist skills but also losing specialists in whom it has a substantial development investment.

It is very clear that the policies and processes by which classifications for technical specialist positions are established need to be reviewed and revised to recognize the technical knowledge and expertise required by the job. Particularly at the higher levels, this knowledge and expertise requirement receives little or no relative weight when, in fact, it may well be the job's most important component.

Given this environment, an appropriate strategy for the government is one which aims at the development and retention of its own specialists rather than competing for scarce resources in an arena in which success is unlikely.

We recommend that:

26. **The Human Resources Secretariat, in concert with the ministries, develop a long range human resources plan for information technology staff, including:**

a) an aggressive recruitment program aimed at entry-level information technology professionals;

b) ongoing, planned career development of information technology staff.

These recommendations, along with the technical education recommended earlier, should improve the government's ability to acquire, develop and retain an appropriate group of persons with advanced technical skills.

As the use of information technology pervades all ministry operations and technology planning is implemented, the executive directly responsible for information technology becomes an increasingly critical member of the ministry management team. The required mixture of sound technical understanding and well-developed business skills is a rare commodity in the marketplace. As with technical specialists, current government salary scales are not attractive to qualified candidates. The government also faces the same risks of failure to attract and possibility of loss. Accordingly, the recommended strategy for information technology executive strength is similar to that for specialists. That is, the government should develop its own technology executives. In order to do so, in addition to the training and development programs discussed earlier, the government needs to increase compensation levels for its most senior technology managers. This will help the government to develop, attract and retain competent executives.

We recommend that:

27. **As their technology investment and use expands, ministries consider elevating the senior systems management position to a level compatible with other senior positions and more likely to attract and retain competent executives, and central agencies recognize the need to be flexible in approving higher level positions or special compensation arrangements.**

7.3 Program development

The very clear need to develop the necessary skills in information technology cannot be overemphasized. The introduction of information technology will not, by itself, cause the improvements we know are possible. It merely provides new tools to get the job done. The fact is that people deliver government programs and services.

A considered ministry strategy will devote a reasonable number of admittedly scarce personnel to continually upgrade the knowledge-base of all ministry staff and to guide on-the-job training activities which reinforce the knowledge and skills obtained from classroom education. The real leverage of information technology will come when knowledgeable people are planning, implementing and using the new tools.

8. Summary of Strategy Recommendations

Recommendation 1.

Ministry management recognize information technology as a powerful resource with which it can bring about significant program delivery and organizational improvement rather than as a set of limited-use administrative tools

Recommendation 2.

The effective use of information technology be recognized as an important aspect of the managerial environment

Recommendation 3.

Ministry senior management take the lead in preparing long-range technology plans to support, reinforce and expand the ministry's business strategy. Such plans must be based on an overall information technology architecture that interrelates all major ministry applications and collections of data.

Recommendation 4.

The government commit to the development of an information technology environment which encourages and supports managers, professionals and staff to participate directly in the development and use of information systems ("end-user computing").

Recommendation 5.

Ministries involve their employees and the union at appropriate stages in the introduction of information technology.

Recommendation 6.

The government ensure that a high degree of employment security related to the introduction and use of information technology is achieved by carefully planned retraining, redeployment, relocation and/or reassignment of staff, in addition to the employment security achievable as a result of natural attrition.

Recommendation 7.

All information technology plans and the implementation of those plans consider staff needs in terms of job design, training and working environment.

Recommendation 8.

Procedures be developed for monitoring and evaluating the impact of technology on women, and ensuring that women are able to take advantage of opportunities presented by technology.

Recommendation 9.

Ministry investment guidelines for information technology projects be expanded to include related end-user and employee costs, as well as benefits of a social nature, service improvements, improved decision-making and productivity gains.

Recommendation 10.

Authority and responsibility for the use of information technology be delegated to deputy ministers, with a clear understanding of their accountability to the Cabinet for results and to Management Board for the observance of good technology management practices.

Recommendation 11.

To maintain accountability, ministries submit to Management Board their short and long range plans for the use of information technology, with acceptance of these plans being the basis upon which authority is initially delegated, and with continued delegation being based on achievement of planned results.

Recommendation 12.

Ministries designate a senior executive to be responsible for the development and integration of all information technology plans relating to computers, telecommunications and office systems.

Recommendation 13.

The Information Technology Division (ITD) of the Management Board Secretariat, assume the role of technology management leadership for the government, through support of ministries in the establishment of sound technology management practices, and through advice to Management Board on the quality of and performance against ministry plans.

Recommendation 14.

Corporate policies be changed to give ministries the freedom to choose, acquire and manage the computing facilities that best meet their needs

within the framework of the comprehensive long-range information technology plan submitted to Management Board. Business cases for ministry datacentres would have to be justified on the basis of benefits not only to the ministry but to the government as a whole.

Recommendation 15.

MGS continue to provide shared processing services to the ministries, on a cost recovery basis and in competition with the private sector. MGS is to be the only ministry offering such services.

Recommendation 16.

Each ministry be responsible for setting standards for, and managing all telecommunications networks which are internal to the ministry and are intra-building ("Local Area Networks").

Recommendation 17.

MGS be responsible for managing all inter-ministry and inter-building telecommunications, and for developing and recommending to Management Board any related standards.

Recommendation 18.

MGS prepare a strategy for the delivery and management of telecommunications province-wide. The strategy should consider the existence today of individual ministry communications systems which have unique requirements related to security, radio transmission and remote location. As part of this strategy, MGS should prepare a phased plan for the design, development and expansion of an integrated provincial voice/data network, utilizing digital technology wherever practical.

Recommendation 19.

As a matter of policy, the "buy" option always be considered by ministries as an alternative to custom software development.

Recommendation 20.

The government recognize the need to identify, acquire and support strategic information technology products that have wide application and benefit to multiple ministries.

Recommendation 21.

The government consider the establishment of an Office of Information Technology (OIT) with the mandate to:

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d) That the majority of its work be carried out in conjunction with a ministry or ministries, based on real identified technology needs with applicability across the whole government;

Recommendation 23.

Innovative, high-risk projects using state-of-the-art technology and with potentially attractive government-wide benefit be financed through a Technology Opportunity Fund and carried out by the sponsoring ministry, with OIT participation at the option of the ministry.

Recommendation 24.

Ministries and the Human Resources Secretariat institute a long range human resources planning activity with respect to information technology in

order to identify and plan for the education and training necessary for the government's employees and managers.

Recommendation 25.

The Human Resources Secretariat ensure the availability of education programs addressing the following needs:

a) Skills in information technology and its management, for the government's senior managers;

b) Skills in information technology, for employees who will use it in their jobs and for their managers;

c) Skills in business and general management, for managers in the information technology function;

d) Skills in consultative assistance for employees now in technical functions;

e) Advanced technical skills for employees who are to be the government's technical specialists.

Recommendation 26.

The Human Resources Secretariat, in concert with the ministries, develop a long range human resources plan for information technology staff, including:

a) An aggressive recruitment program aimed at entry-level information technology professionals;

b) Ongoing planned career development of information technology staff.

Recommendation 27.

As their technology investment and use expands, ministries consider elevating the senior systems management position to a level compatible with other senior positions and more likely to attract and retain competent executives, and central agencies recognize the need to be flexible in approving higher level positions or special compensation arrangements.

Appendix A

Participants in the Information Technology Strategy Study

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Appendix B

REPORTS TO THE INFORMATION TECHNOLOGY STRATEGY STEERING COMMITTEE

SUPPORTING REPORTS

Title	Undertaken by:
Management of End-User Computing Technology	Ministry of Revenue
Human Resources and Technology	Civil Service Commission
Technology Planning and Investment	Ministry of Revenue
Systems Development Management and Methodologies	Ministry of Community and Social Services
Communications	Ministry of Government Services and Ministry of Transportation and Communications
Procurement of Goods and Services	Ministry of Education and Ministry of Transportation and Communications
Corporate Services and Organization	Ministry of Health